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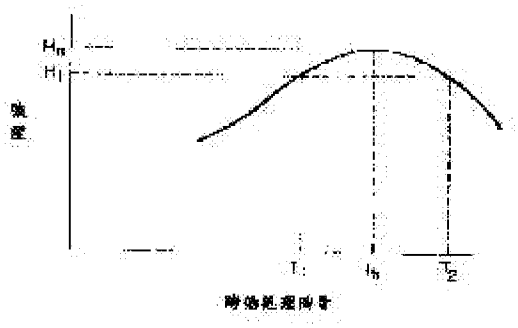
(54) WORKING METHOD FOR ALUMINUM ALLOY EXTRUDED SHAPE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a working method for an Al alloy extruded shape, capable of manufacturing an Al alloy extruded shape excellent in bendability and energy absorption characteristic.
SOLUTION: An Al alloy, having a composition consisting of, by weight, 0.6–1.2% Si, 0.5–1.0% Mg, 0.1–0.4% Fe, 0.2–0.6% Mn, 0.005–0.1% Ti, 0.05–0.3%; Cr and/or 0.05–0.25% Zr, and the balance Al with inevitable impurities, is extruded. The resultant Al alloy extruded shape is subjected to primary heat treatment under the aging condition T1 before the aging condition Th where the highest strength Hh of the Al alloy is reached. Then, bending is applied. Subsequently, secondary heat treatment is carried out under the aging condition T2 beyond the aging condition Th where the highest strength Hh of the Al alloy is reached.



CLAIMS

[Claim(s)]
[Claim 1]For Mg Fe 0.5 to 1.0% of the weight 0.6 to 1.2% of the weight 0.1 to 0.4 % of the weight, [Si] Contain Ti for Mn and 0.05 to 0.3 % of the weight and/or Zr are contained for Cr 0.05 to 0.25% of the weight 0.005 to 0.1% of the weight 0.2 to 0.6% of the weight, From an aging condition from which the highest intensity of this aluminum alloy is obtained, by a front aging condition, perform 1st heat treatment to aluminum alloy extrudate obtained by the remainder carrying out extrusion molding of the aluminum alloy which consists of aluminum and an inevitable impurity, and it ranks second to it, A processing method of an aluminum alloy extruded section performing bending and performing 2nd heat treatment after that by an aging condition beyond an aging condition from which the highest intensity of said aluminum alloy is obtained.
[Claim 2]A processing method of the aluminum alloy extruded section according to claim 1, wherein said aluminum alloy contains Cu

0.4 to 0.8% of the weight.
[Claim 3]A processing method of the aluminum alloy extruded section according to claim 1 or 2 in which said extrudate is characterized by a section consisting of a hollow extruded material of polygonal shape.
[Claim 4]A processing method of the aluminum alloy extruded section according to any one of claims 1 to 3 in which said 1st heat treatment is the conditions of 1 to 24-hour maintenance, and is characterized by being carried out on condition of 150-220 ** 1 to 24-hour maintenance of said 2nd heat treatment at 120-180 **.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]When especially this invention manufactures the aluminum alloy extruded section excellent in energy absorption characteristics, such as a side member which constitutes the car body structure made from aluminum of space frame structure, about the processing method of an aluminum alloy extruded section, it is used, and it relates to the processing method of a suitable aluminum alloy extruded section.
[0002]
[Description of the Prior Art]In the engine part ahead of a car, and a back suitcase portion, the side member of a car is a member with the function to secure a crew member's safety, when buckling distortion is carried out to accordion shape at the time of a collision and this absorbs the impact strength at the time of a collision. There are front side members which are prolonged toward back as this side member from the engine room lower part ahead of the body, and are connected to the structural member of a guest room front floor, a rear side member which is prolonged in back from the structural member of a guest room back floor, and reaches the trunk room lower part, etc.
[0003]The conventional side member performs press-forming processing to cold rolled sheet steel, and the cylindrical member of the shape of a rectangular cross section joined using spot welding etc. is used. By the way, are lightweight instead of the weight saving of the car being strongly demanded for the purpose of exhaust gas reduction, fuel consumption improvement, etc., and using a steel plate and a steel pipe as part of this weight saving from environmental problems, such as global warming, in recent years, And the light alloy extruded section which uses as the main ingredients light metals, such as aluminum which can manufacture the structure of complicated shape by one, and Ti, is examined. As a light alloy suitable for such an extruded section, aluminum-Mg-Si system aluminum alloys, such as JIS6N01 good alloy of the balance of extrusion nature, mechanical properties, corrosion resistance, etc., are mainly used now.
[0004]For example, in order to manufacture the member which constitutes the car body structure made from aluminum of space frame structures, such as a side member, it is first considered as the aluminum alloy extrudate which has various sectional shape by carrying out extrusion molding of the aluminum alloy. Subsequently, high temperature aging is performed to this aluminum alloy extrudate by the aging condition from which the highest intensity of this aluminum alloy is obtained, and bending is performed to it after that. Subsequently, junction processing of welding etc. is performed and it is considered as the member for aluminum car body structures (A process). The member for aluminum car body structures can also be obtained by B process made to be the same as that of A process mentioned above except the point of performing bending to said aluminum alloy extrudate, and performing high temperature aging by the aging condition from which the highest intensity of this aluminum alloy is obtained after that.
[0005]
[Problem(s) to be Solved by the Invention]By the way, in the side member which absorbs the member which constitutes the conventional car body structure made from aluminum mentioned above, and the energy which carries out buckling distortion to accordion shape at the time of a collision, and is especially added from a cross direction, While the bending nature in a manufacturing process is good, the energy at the time of a collision is fully absorbed by carrying out buckling distortion to accordion shape, and the function to make it a crew member's damage serve as the minimum is also required.
[0006]In the conventional A process, since bending is performed after performing high temperature aging to aluminum alloy extrudate, there is a problem that there is a possibility that a crack may arise at the time of bending of this extrudate, or a crack may arise at the time of axial compression loading. In the conventional B process, since high temperature aging is performed after performing bending to aluminum alloy extrudate, there is a problem that there is a possibility that cross-sectional deformation may become large at the time of bending of this extrudate. There is a problem that it is difficult to reconcile bending nature and an energy absorption characteristic, and either will fall victim also in which process of A process mentioned above and B process by the above.
[0007]In light of the above-mentioned circumstances, this invention is ****. The purpose is to provide the processing method of the aluminum alloy extruded section which can manufacture the aluminum alloy extruded section excellent in the sex and the energy absorption characteristic.

[0008]
[Means for Solving the Problem]A result of having conducted various experiments influence of a manufacturing process on bending nature and an energy absorption characteristic of aluminum alloy extrudate being made clear in order that this invention persons may solve an aforementioned problem, The knowledge of an aluminum alloy extruded section excellent in bending nature and an energy absorption characteristic being obtained was carried out by performing the 1st heat treatment, bending, and 2nd heat treatment to aluminum alloy extrudate of a presentation concerning this invention one by one.
[0009]This invention is based on the above knowledge and a processing method of the aluminum alloy extruded section according to claim 1, For Mg Fe 0.5 to 1.0% of the weight 0.6 to 1.2% of the weight 0.1 to 0.4 % of the weight, [Si] Contain Ti for Mn and 0.05 to 0.3 % of the weight and/or Zr are contained for Cr 0.05 to 0.25% of the weight 0.005 to 0.1% of the weight 0.2 to 0.6% of the weight, From an aging condition from which the highest intensity of this aluminum alloy is obtained, by a front aging condition, perform 1st heat treatment to aluminum alloy extrudate obtained by the remainder carrying out extrusion molding of the aluminum alloy which consists of aluminum and an inevitable impurity, and it ranks second to it, It is characterized by performing bending and performing 2nd heat treatment after that by an aging condition beyond an aging condition from which the highest intensity of said aluminum alloy is obtained.
[0010]A processing method of the aluminum alloy extruded section according to claim 2 is characterized by said aluminum alloy containing Cu 0.4 to 0.8% of the weight in a processing method of the aluminum alloy extruded section according to claim 1.
[0011]As for a processing method of the aluminum alloy extruded section according to claim 3, in a processing method of the aluminum alloy extruded section according to claim 1 or 2, said extrudate is characterized by a section consisting of a hollow extruded material of polygonal shape.
[0012]A processing method of the aluminum alloy extruded section according to claim 4, In a processing method of the aluminum alloy extruded section according to any one of claims 1 to 3, said 1st heat treatment is the conditions of 120–180 ** 1 to 24–hour maintenance, and it is characterized by performing said 2nd heat treatment on condition of maintenance at 150–220 ** for 1 to 24 hours.
[0013]By performing 1st heat treatment by a front aging condition from an aging condition from which the highest intensity of this aluminum alloy is obtained by aluminum alloy extrudate obtained by carrying out extrusion molding of the aluminum alloy in a processing method of an aluminum alloy extruded section of this invention, In aluminum alloy extrudate to which this 1st heat treatment was performed, moreover, elongation is not too hard well by being generated by detailed sludge, and it becomes the thing excellent in bending nature. Subsequently, a value of elongation becomes possible [carrying out bending also to complicated high bending shape] by performing bending. And since he is also following age–hardening, yield strength is also high. For example, when aluminum alloy extrudate which carries out bending has a centrum, it becomes possible to suppress cross–sectional deformation of this centrum small.
[0014]Aluminum alloy extrudate which performed this bending by performing 2nd heat treatment by an aging condition beyond an aging condition from which the highest intensity of said aluminum alloy is obtained, since an energy absorption characteristic is inferior, Though it is high intensity, a deformation behavior at the time of the same compressive load as a low–strength alloy becomes possible, and aluminum alloy extrudate to which this 2nd heat treatment was performed enables it to improve an energy absorption characteristic, because a sludge becomes big and rough. Although conditions of the 1st and the 2nd heat treatment are changed with alloy composition, What is necessary is in the case of an aluminum alloy concerning this invention, to make prescription temperature into the range of 120–180 **, and to make retention time into 1 to 24 hours, and to make prescription temperature into the range of 150–220 ** in the 2nd heat treatment, and just to make retention time into 1 to 24 hours by the 1st heat treatment.
[0015]Next, a reason which limited a presentation of an aluminum alloy concerning this invention is explained. An aluminum alloy concerning this invention for Si Mg 0.6 to 1.2% of the weight 0.5 to 1.0 % of the weight, It has the presentation which contains Ti for Mn 0.2 to 0.6% of the weight 0.1 to 0.4% of the weight, and contains 0.05 to 0.3 % of the weight, and/or Zr for Cr 0.05 to 0.25% of the weight 0.005 to 0.1% of the weight, and the remainder becomes from aluminum and an inevitable impurity about Fe. Said aluminum alloy is good also as containing Cu 0.4 to 0.8% of the weight.
[0016]Si and Mg have the operation which deposits as a detailed Mg_2Si compound and raises intensity in an aluminum alloy. When content of less than 0.6 % of the weight and Mg will be less than 0.5% of the weight in content of Si, a precipitation amount of a Mg_2Si compound decreases and it becomes impossible here, to secure desired intensity as a result. If content of Si exceeds 1.2 % of the weight and content of Mg exceeds 1.0%, while a precipitation amount of a Mg_2Si compound will increase and extrusion nature and bending nature will fall, it becomes easy to generate a crack by modification at the time of a collision. Therefore, content of Mg was made into 0.5 to 1.0 % of the weight for content of Si 0.6 to 1.2% of the weight. The range of content of 0.65 to 0.95 % of the weight and Mg with the desirable desirable range of content of Si is 0.55 to 0.95 % of the weight.
[0017]After Fe, Mn, and Cr and/or Zr have lived together, a detailed intermetallic compound is generated, this intermetallic compound distributes in an aluminum alloy after homogenization, and Fe, Mn, Cr, and Zr promote development of fibrous structure while controlling recrystallization at the time of extrusion remarkably. As a result, there is an operation make hard to generate a crack by modification at the time of a collision.
[0018]Less than 0.1% of the weight, in content of Mn, if content of Zr will be less than 0.05% of the weight less than 0.05% of the weight less than 0.2% of the weight in content of Cr, content of Fe here, If will become insufficient [the effect], and content of Fe exceeds 0.4 % of the weight, content of Mn exceeds 0.6 % of the weight, content of Cr exceeds 0.3 % of the weight and content of Zr exceeds 0.25 % of the weight, A big and rough intermetallic compound comes to generate, and it becomes easy to generate a crack by modification at the time of a collision.
[0019]Therefore, content of 0.05 to 0.3 % of the weight and/or Zr was made [content of Fe / content of Mn] into 0.05 to 0.25 % of the weight for content of Cr 0.2 to 0.6% of the weight 0.1 to 0.4% of the weight. The desirable ranges of content of Fe, Mn, Cr, and Zr are Fe:0.15–0.3 % of the weight, Mn:0.25–0.45 % of the weight, Cr:0.07–0.2 % of the weight, and Zr:0.07–0.15 % of the weight.
[0020]Ti carries out minuteness making of the organization of an aluminum alloy, and there is an operation which prevents a crack. If content of Ti will be less than 0.005% of the weight, an effect of preventing a crack will not be acquired, and if the content exceeds

0.1 % of the weight, it will come to generate a big and rough intermetallic compound, and as a result, it becomes easy to generate a crack by modification at the time of a collision here. Therefore, content of Ti was made into 0.005 to 0.1 % of the weight. The desirable range of content of Ti is 0.005 to 0.05 % of the weight.

[0021]Cu has the operation which dissolves in an aluminum alloy and raises intensity. Here, if content of Cu will be 0.4 or less % of the weight, the desired improving strength effect will not be acquired, and if the content exceeds 0.8 % of the weight, bending nature and corrosion resistance will come to fall. Therefore, content of Cu was made into 0.4 to 0.8 % of the weight. The desirable range of content of Cu is 0.45 to 0.65 % of the weight.

[0022]

[Embodiment of the Invention]One embodiment of the processing method of the aluminum alloy extruded section of this invention is described based on a drawing. The flow chart in which drawing 1 shows one embodiment of the processing method of the aluminum alloy extruded section of this invention, and drawing 2 are the figures showing the prescription curve showing the relation between aging treatment time and the intensity of aluminum alloy extrudate. In the processing method of this aluminum alloy extruded section, Si 0.6 to 1.2 % of the weight, For Fe Mn 0.1 to 0.4% of the weight 0.5 to 1.0% of the weight 0.2 to 0.6 % of the weight, [Mg] Ti is contained 0.005 to 0.1% of the weight, 0.05 to 0.3 % of the weight and/or Zr are contained for Cr 0.05 to 0.25% of the weight, and the remainder carries out extrusion molding of the aluminum alloy which consists of aluminum and an inevitable impurity. Said aluminum alloy is good also as containing Cu 0.4 to 0.8% of the weight.

[0023]The aluminum alloy extrudate produced by carrying out extrusion molding of this aluminum alloy is extrudate for bendings with which a section consists of a hollow extruded material of polygonal shape, for example, the cylinder member which has a section of thick fixed rectangular shape. Subsequently, as shown in this aluminum alloy extrudate at drawing 2, aging treatment 1 (1st heat treatment) is performed by front aging treatment time (**********) T_1 from aging treatment time (aging condition) T_h from which highest intensity H_h of this aluminum alloy is obtained. Intensity H_1 in this aging treatment time T_1 is lower than highest intensity H_h. Thereby, in the aluminum alloy extrudate to which aging treatment 1 was performed, it is generated by the detailed sludge, and well, elongation is not too hard and, moreover, becomes the thing excellent in bending nature.

[0024]Subsequently, bending is performed to this aluminum alloy extrudate. It incurvates this aluminum alloy extrudate in a vertical plane, this bending method pressing down the end part of aluminum alloy extrudate, and is processed using a bending apparatus as shown in drawing 3 and drawing 4. Approximately wheel-like 3 [rotary bending type] which has the medial axis C to which this bending apparatus 1 carries out bending of the tubed aluminum alloy extrudate 2 which has a section of rectangular shape, Move presser-foot type 4 which is provided in the method of the outside of one side of the medial axis C of this rotary bending type 3, and presses down one straight-line portion 2a of the aluminum alloy extrudate 2 from the upper part, It is provided on the same horizon as move presser-foot type 4, and the aluminum alloy extrudate 2 is grasped with the clamp part 3a shown with the figure omission triangular shape of rotary bending type 3, Outline composition is carried out from clamped type (bolting type) 5 which moves to right-hand side from the left-in-the-figure side toward straight-line partial 2b of another side of the aluminum alloy extrudate 2 in the middle of bending.

[0025]Here, as shown in drawing 3, the approximately center part of said aluminum alloy extrudate 2 is laid in the clamp part 3a of rotary bending type 3, and one straight-line portion 2a of this aluminum alloy extrudate 2 is pressed down from the upper part by move presser-foot type 4. And as shown in drawing 4, figure Nakamigi rotation of said rotary bending type 3 is slowly carried out around that medial axis C in this state, straight-line partial 2b of this aluminum alloy extrudate 2 is doubled with the curvature radius of said rotary bending type 3, and bending is turned upward into a vertical plane at a convex.

[0026]Bending of the angle theta of the extension wire of the straight-line portion 2a and straight-line partial 2b of another side to make is carried out by the above so that it may become a predetermined angle, and aluminum alloy extrudate 2 prolonged in linear shape is made aluminum alloy extrudate 2'. This aluminum alloy extrudate 2' can carry out bending also to bending shape with it. [a high value of elongation, and] [complicated] Since he is also following age-hardening, yield strength is also high. Since it is a cylinder member which has a section of rectangular shape, it is possible to suppress the cross-sectional deformation of a cylinder member small.

[0027]Since the energy absorption characteristic is inferior in this aluminum alloy extrudate 2', as shown in drawing 2, aging treatment 2 (2nd heat treatment) is performed by aging treatment time (overaging conditions) T_2 beyond aging treatment time T_h from which highest intensity H_h of this aluminum alloy is obtained. The intensity in this aging treatment time T_2 is almost equally [to intensity H_1 in aging treatment time T_1] lower than highest intensity H_h. Thereby, the aluminum alloy extrudate to which this aging treatment 2 was performed enables intensity to give the energy absorption characteristic of that which falls a little because a sludge becomes big and rough.

[0028]Here, the example of the processing method of the aluminum alloy extruded section of this embodiment is described.

[EXAMPLE] Two kinds of aluminum alloys in which presentations differ were prepared first. Here, it is A alloy (Si:0.9 % of the weight, Mg:0.95 % of the weight, Fe: 0.3% of the weight). Mn: 0.4 % of the weight, Ti:0.01 % of the weight, Zr : It contains 0.10% of the weight, The aluminum alloy and B alloy (Si: 0.85% of the weight) in which the remainder consists of aluminum and an inevitable impurity Mg: 0.8 % of the weight, Cu:0.6 % of the weight, Fe:0.25 % of the weight, Mn:0.4 % of the weight, Ti:0.07 % of the weight, Zr: It contained 0.12% of the weight, and the remainder could be two kinds of aluminum alloys which consist of aluminum and an inevitable impurity.

[0029]Subsequently, the manufacturing process shown in Table 1 to this A alloy and B alloy performed extrusion molding, heat treatment (any one sort or two sorts of the aging treatment 1, the aging treatment 2, and the aging treatment 3), and bending, and it was considered as the member made from the extruded section of sample No.1 - 7. Here, sample No.1 and 2 are [this example and the samples 3-7] comparative examples. The conditions of the aging treatment 1-3 are 3:180 ** of aging treatment x 7 hours for 2:205 ** of aging treatment x 6 hours for 1:150 ** of aging treatment x 12 hours. The conditions of extrusion molding were considered as extrusion temperature:500 **, extrusion rate:7 m/min, and cooling:water cooling, and extrusion molding was carried out to the shape of a hollow square pipe whose thickness the outside dimension of a rectangular cross section is 50x75 mm, and is 2 mm, and they were used as extrudate. The aging treatment 3 performs aging treatment by aging treatment time T_h from which highest intensity H_h of A alloy is obtained. Subsequently, the compression test which carries out load of the load to shaft orientations was done, and crush characteristic evaluation was performed. The result is shown in Table 1.

[0030]
[Table 1]

	試料No.	Al合金組成	製造工程	加工性	圧潰特性
実施例	1	A	押出→時効処理1→曲げ加工→時効処理2	良好	良好
	2	B	押出→時効処理1→曲げ加工→時効処理2	良好	良好
比較例	3	A	押出→曲げ加工→時効処理1	変形大	破壊
	4	A	押出→曲げ加工→時効処理2	変形大	やや良
	5	A	押出→時効処理1→曲げ加工→時効処理3	良好	破壊
	6	B	押出→時効処理1→曲げ加工	良好	破壊
	7	B	押出→時効処理2→曲げ加工	割れ	-

[0031]The samples 1 and 2 which are the extruded sections of this example shown in Table 1 had few cross-sectional deformation and cracks at the time of bending, and their processability was good. It was in ** that carry out a compression set to the shape of an accordion, without a crack occurring also in a compression test, and the energy absorption characteristic is also excellent. On the other hand, in the sample (No.3, 4) which performed the aging treatment 1 or aging treatment 2 by the post process of bending. before the modification at the time of bending carries out [in / it is large and / a compression test] a compression set to the shape of an accordion -- being divided (destruction) -- although the compression set was made the shape of an accordion, the crack was accepted selectively (a little -- right).
[0032]By the sample (No.5) which performed aging treatment 1 by the previous process of bending, and performed aging treatment 3 by the post process, although processability was good, before carrying out a compression set to the shape of an accordion, it has been divided in the compression test (destruction). By the sample (No.6) which performed aging treatment 1 by the previous process of bending, although processability was good, before carrying out a compression set to the shape of an accordion, it has been divided in the compression test (destruction). In the sample (No.7) which performed aging treatment 2 by the previous process of bending, the crack has arisen at the time of bending (divide).
[0033]As explained above, according to the processing method of the aluminum alloy extruded section of one embodiment of this invention. For Mg Fe 0.5 to 1.0% of the weight 0.6 to 1.2% of the weight 0.1 to 0.4 % of the weight, [Si] Contain Ti for Mn and 0.05 to 0.3 % of the weight and/or Zr are contained for Cr 0.05 to 0.25% of the weight 0.005 to 0.1% of the weight 0.2 to 0.6% of the weight, The remainder carries out extrusion molding of the aluminum alloy (Cu may be contained 0.4 to 0.8% of the weight) which consists of aluminum and an inevitable impurity, Since aging treatment 1 is performed to the obtained aluminum alloy extrudate by front aging treatment time T_1 from aging treatment time T_h from which highest intensity H_h is obtained, moreover, elongation is not too hard well to it by being generated by the detailed sludge, and, as a result, bending nature can be improved to it.
[0034]Since bending is performed to this aluminum alloy extrudate, bending can be carried out also to bending shape with it. [a high value of elongation, and] [complicated] Therefore, modification of a centrum can be suppressed small, a core like before can be omitted depending on the sectional shape of extrudate, and the cost of a metallic mold can be reduced. And since age-hardening is progressing, yield strength can be raised.
[0035]Since aging treatment 2 is performed by aging treatment time T_2 which exceeded aging treatment time T_h from which highest intensity H_h is obtained to the aluminum alloy extrudate which performed bending, Though it is high intensity, it can be considered as the deformation behavior at the time of the same compressive load as a low-strength alloy, and an energy absorption characteristic can be improved because a sludge becomes big and rough.
[0036]As mentioned above, although one embodiment of the aluminum alloy extruded section of this invention has been described based on a drawing, change etc. of a design in the range which is not limited to this embodiment and does not deviate from the gist of this invention are possible for concrete composition. For example, the presentation of an aluminum alloy can be changed if needed in the range of the presentation mentioned above, without being limited to the above-mentioned example.
[0037]
[Effect of the Invention]Since 1st heat treatment is performed by a front aging condition from the aging condition which carries out extrusion molding of the aluminum alloy and from which the highest intensity of this aluminum alloy is obtained by the obtained aluminum alloy extrudate according to the processing method of the aluminum alloy extruded section of this invention as explained above, By being generated by the detailed sludge, well, moreover, elongation is not too hard and, as a result, can improve bending nature. Since bending is performed to the aluminum alloy extrudate which performed 1st heat treatment, bending can be carried out also to bending shape with it. [a high value of elongation, and] [complicated] And since age-hardening can be set forward, yield strength can be raised.
[0038]Since 2nd heat treatment is performed by the aging condition which exceeded the aging condition from which the highest intensity of said aluminum alloy is obtained to this aluminum alloy extrudate, Though it is high intensity, it can be considered as the deformation behavior at the time of the same compressive load as a low-strength alloy, and an energy absorption characteristic can be improved because a sludge becomes big and rough.
[0039]The processing method of the aluminum alloy extruded section which can manufacture the aluminum alloy extruded section excellent in bending nature and an energy absorption characteristic by the above can be provided.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a flow chart showing one embodiment of the processing method of the aluminum alloy extruded section of this invention.
[Drawing 2]It is a figure showing the prescription curve showing the relation between aging treatment time and the intensity of aluminum alloy extrudate.
[Drawing 3]It is a front view showing the outline composition of the bending apparatus for performing bending in the aluminum alloy extrudate of this invention.
[Drawing 4]It is a front view showing 1 operation of a bending apparatus.
[Description of Notations]
1 Bending apparatus
2 and 2' aluminum alloy extrudate
2a and 2b Straight-line portion
3 Rotary bending type
3a Clamp part
4 Move presser-foot type
5 Clamped type (bolting type)
C Medial axis
theta Angle

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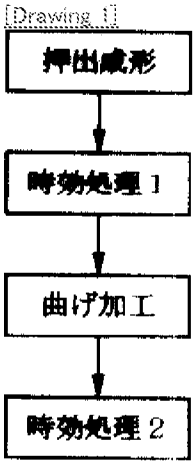
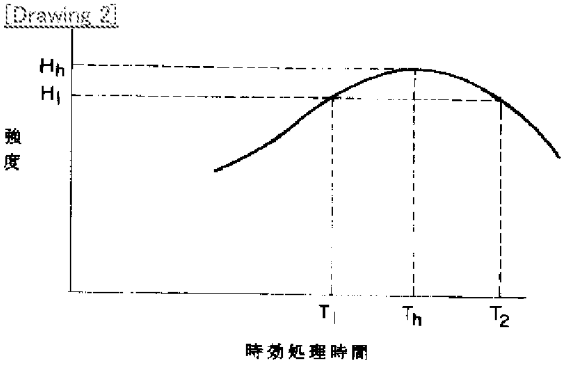
DRAWINGS

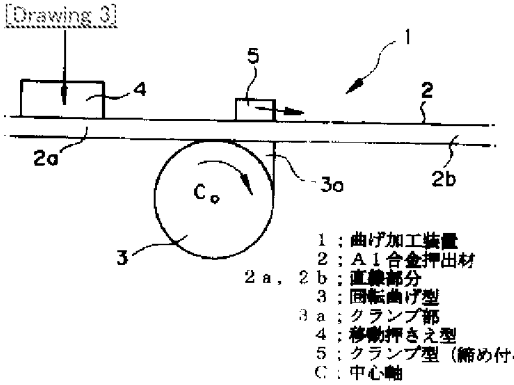
[Drawing 1]



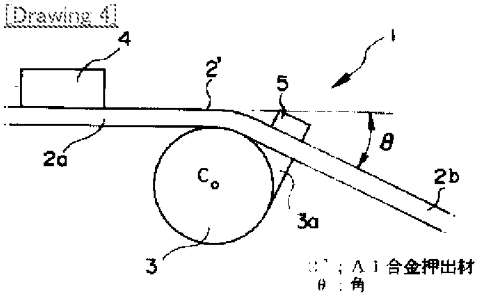
[Drawing 2]



[Drawing 3]



[Drawing 4]



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